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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/763,244

01/26/2004

Taishi Kubota

8040-1052

8011

466

7590

05/17/2006

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EXAMINER

DANG, TRUNG Q

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 05/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/763,244

Applicant(s)

KUBOTA ET AL.

Examiner

Trung Dang

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 5, 11, 12 and 14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 5, 11, 12, and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>5/8/06</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 5 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moon et al. (US 5,719,085 of record) in view of Chang (US 6,566,224 of record).

With reference to Figs. 3C-3D, Moon teaches an oxidation method of a semiconductor substrate having an STI region, comprising the steps of:

etching a semiconductor region to form a trench (Fig. 3C);
preparing dichloroethylene (DCE) (the DCE is utilized in the subsequent oxidation process, hence the DCE has to be prepared); and
subjecting an exposed inside upper end portion of the trench to halogen oxidation with the dichloroethylene and oxygen ambient with an approximately 9% HCl to O₂ equivalency, whereby a thickness of an oxide corner portion 317 of the semiconductor region adjacent to said upper end portion of the trench is greater than a thickness of said oxide film at other portions of the trench, the halogen oxidation being carried out at temperature of approximately 920°C in an atmosphere within a furnace (Fig. 3D and col. 5, lines 28-50).

Moon differs from the claims in not disclosing the concentration of DCE in an oxygen environment within a range as claimed.

In the same field of endeavor, Chang teaches an oxidation process in which sidewalls of an isolation trench are oxidized in an oxidizing environment comprises DCE and oxygen, wherein the concentration of DCE in the oxygen environment is about 1% (col. 5, lines 16-19).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Moon's process by selecting the concentration of DCE in the oxygen environment of about 1% as suggested by Chang because it is known that oxidation in an ambient containing high concentration of HCl (produced by the chemical reaction of DCE and oxygen) produces facets, thus reducing the DCE concentration would have the benefit of rounding the trench corner while minimizing facets (see col.3, lines 36-45 of Olsen's reference of record. The Olsen reference is cited herein merely for the purpose of showing this fact and not applied in the rejection).

As for the claimed limitation regarding a stress imposed on the upper corner portion of the trench to less than 100 MPa, absent evident to the contrary, it would have been obvious that such stress would inherently result at the corner 317 because process parameters such as temperature and DCE concentration of the combined method overlap the range as claimed.

As for the claimed temperature range that is not disclosed in Moon, the determination of such temperature range outside that of disclosed by Moon would have

been obvious to one of ordinary skill in the art because it is well settled that, absent a showing of criticality or unexpected result by applicant, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d (Fed.cir), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed temperature range or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen temperatures or upon another variable recited in the claim, the applicant must show that the chosen temperatures are critical. *In re Woodruff*, 919 F.2d, 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

3. Claims 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moon et al. taken with Chang et al. as applied to claims 5 and 11 above, and further in view of Chau et al. (US 5,891,809 of record).

The combined process of Moon and Chang teaches an oxidation method of a semiconductor device having an STI region as described in the above 103 rejection.

The combination differs from the claim in not disclosing that the DCE is introduced together with oxygen into the oxidizing furnace by bubbling nitrogen

through liquid DCE.

Chau teaches an oxidation process in which the introduction of DCE into the furnace is carried out by bubbling nitrogen through liquid DCE (col. 3, lines 56-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combined process by introducing the DCE into the furnace using nitrogen as a carrier gas in the bubbling manner as suggested by Chau because such technique of introducing a reactant gas by bubbling an inert carrier gas through a liquid containing the reactant gas is known in the art, and the application of an old process to perform the same would have been within the level of one skilled in the art.

4. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over the CN 1392604A cited by applicants.

The CN teaches an oxidation method of oxidizing an inner wall of a trench formed in a semiconductor region a semiconductor substrate, the method comprising the steps of:

preparing dichloroethylene (DCE) (the DCE is utilized in the subsequent oxidation process, hence the DCE has to be prepared); and
carrying out halogen oxidation of an exposed inner wall of the trench using the DCE and oxygen to form oxide layer 114 (Fig. 3),

the halogen oxidation being carried out at a temperature between 900⁰C and 1150 °C in an atmosphere within a furnace, by controlling a concentration of the DCE within a range between 0.5 and 5.0% by weight (page 2).

The CN'604 differs from the claimed in not disclosing the stress level as claimed. However, it would have been obvious that such stress would inherently result at the corner of the trench because process parameters such as temperature and DCE concentration of the CN' 604 overlap the range as claimed.

5. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over the CN' 604 as applied to 11 above, and further in view of Chau et al. (US 5,891,809 of record).

The CN' 604 teaches an oxidation method of a semiconductor device having an STI region as described in the above 103 rejection.

The CN' 604 differs from the claim in not disclosing that the DCE is introduced together with oxygen into the oxidizing furnace by bubbling nitrogen through liquid DCE.

Chau teaches an oxidation process in which the introduction of DCE into the furnace is carried out by bubbling nitrogen through liquid DCE (col. 3, lines 56-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of the CN' 604 by introducing the DCE into the furnace using nitrogen as a carrier gas in the bubbling manner as suggested by Chau because such technique of introducing a reactant gas by bubbling an inert carrier

gas through a liquid containing the reactant gas is known in the art, and the application of an old process to perform the same would have been within the level of one skilled in the art.

Response to Arguments

6. Applicant's arguments filed 2/28/06 have been fully considered but they are not persuasive.

In page 6 of the Remarks, applicants argue that motivation offered in the Official Action for combining the references is not supported by the teachings of the references. That is, CHANG teaches that oxidation begins to occur at about 950°C but rounding of the corners does not occur until higher temperatures. MOON teaches rounding corners at 920°C, thus it would not have been obvious to combine Chang with Moon.

The Examiner disagrees. As clearly pointed out in the rejection, one of ordinary skill in the art would be motivated to combine Chang with Moon for the benefit of rounding the trench corner while minimizing facets since it is known that oxidation in an ambient containing high concentration of HCl (such as 9% HCl equivalency produced by the chemical reaction of DCE and oxygen as disclosed in Moon) produces facets, thus reducing the DCE concentration taught by Chang would minimize facets (Olsen's reference is cited to showing this fact). As for the temperature issue, applicants are reminded that it is Moon's reference that is used to show the claimed temperature range, not Chang. Apparently, applicants argue on the basis of piecemeal analysis of

the references. However, it is axiomatic that one cannot show nonobviousness by attacking references individually where the rejection, as here, is based on a combination of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981), *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857.

The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Trung Dang
Primary Examiner
Art Unit 2823

5/15/06